

River dolphins out of focus? General target assumptions misrepresent range-dependent biosonar adjustments

Michael Ladegaard^{1*}, Frants Havmand Jensen^{2,3}, Kristian Beedholm¹,
Vera Maria Ferreira da Silva⁴, Peter Teglberg Madsen^{1,5}

¹Zoophysiology, Department of Bioscience, Aarhus University, 8000 Aarhus, Denmark

²Aarhus Institute of Advanced Studies, Aarhus University, 8000 Aarhus, Denmark

³Department of Ecology and Evolutionary Biology, Princeton University, Princeton, NJ 08544, USA

⁴Laboratório de Mamíferos Aquáticos, Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil

⁵Murdoch University Cetacean Research Unit, School of Veterinary and Life Sciences, Murdoch University, South Street, Murdoch, Western Australia 6150, Australia

*Author for correspondence (michael.ladegaard@gmail.com)

Biosonar parameters of toothed whales in the wild are not easily quantified in relation to range adjustments when echolocation context and targets are unknown. Generally, recording arrays are assumed to represent primary targets for clicks following specific on-axis criteria, but animals may just as well be engaged in tasks where biosonar focus is closer to or further away than recording arrays. Therefore, even if acoustic source localisation and on-axis click selection are perfect, the localization range itself may only provide muddled insight into range-dependent biosonar adjustments of wild toothed whales. Specifically, we hypothesize that biosonar parameters are not automatically adjusted to objects like arrays that pass through the biosonar beam and that context plays a significant role in forming the measured parameters. To test this, we conducted a semi-controlled study on wild Amazon river dolphins that approached and intercepted prey presented in front of a two-dimensional hydrophone array thus alleviating uncertainties of echolocation context and focus. We demonstrate that source parameters differ more when comparing known versus unknown target situations within an area than when animals are recorded the same way in different areas. Furthermore, unlike some studies on wild toothed whales, we demonstrate that inter-click intervals are always kept longer than the two-way travel time to target and back, and additionally contain an obvious lag time with a mean >10 ms before subsequent click emissions. We argue that recording arrays cannot necessarily be assumed to attract biosonar focus of wild toothed whales and that range-dependent adjustments should always be critically evaluated in relation to echolocation context. Exploring intra-species source parameter variations has important implications for designing passive acoustic monitoring studies where inadequate knowledge of biosonar parameter use in wild animals may ultimately lead to incorrect estimations of population sizes or species abundance which could impede proper conservation efforts.